1. FEATURES

1.1. Simple connection to the host system. With serial data transmission method, it is possible to choose 2400, 4800, 9600 or 19200 bps.

1.2. Since a DC/DC converter is used, only one voltage +12V is required to operate the module.

1.3. One chip microcontroller offers PC 437 (USA, standard Europe) or PC 850 (multilingual)

1.4. Four brightness levels can be selected by dimming function.

1.5. High quality blue-green (505 nm) vacuum fluorescent display provides an attractive and readable medium.

1.6. Characters are provided with a 5 x 7 dot matrix

2. FUNCTIONS

2.1. Switches

The jumper switches are located on the PCB's right side. Their meaning is explained in table 2.1. The switch settings are read only when the power is turned on. Therefore, changing the settings while the power is on has no effect.

Jumper Switches OPEN/SHORT Combination Table

1	2	3	4	5	6	7	FUNCTION	
Open	Open	X	X	X	X	X	BPS	9,600 bps
Open	Short	X	X	X	X	X		4,800 bps
Short	Open	X	X	X	X	X		2,400 bps
Short	Short	X	X	X	X	X		19,200 bps
X	X	Open	X	X	X	X	Parity	None
X	X	Short	Open	X	X	X		Odd
X	X	Short	Short	X	X	X		Even
X	X	X	X	Open	X	X	Self Test	Perform
X	X	X	X	Short	X	X		No self test
X	X	X	X	X	Open	X	Font Type	PC437
X	X	X	X	X	Short	X		PC 850
Open	Open	Open	Open	Open	Open	Short	Work with DATECS ECR	

2.2. Self-Test Function

2.2.1. Starting the Self-Test

There are two ways to start the self-test, as follows:
1) Use Control Commands
2) Short circuit position "5" of the jumper switch, and then turn the power ON.

2.2.2. Ending the Self-Test

After a series of self-tests is executed, the screen is cleared, the cursor is moved to the home position, and the display goes into the standby state.

The self-test shows the following:
1) The state of the jumper switches
2) Display characters
3) Functions

Note 1) A self-test operation will be executed for 20 seconds approximately.
And when the self-test is being executed, receiving data is not processed. Therefore, host MCU should transmit the data after 20 seconds from the beginning of a self-test.

Note 2) When a self-test is executed using command "US @", the user defined character definitions are retained.

2.3. CHARACTER DATA WRITE-IN

When the character data code (20 Hex ~ FF Hex) is transfered to the display, the character font is diplayed on the screen. At this time, the cursor will be shifted to the right one digit automatically.

3. COMMANDS

3.1. CLR (0C Hex): Clear display screen

Clear all the displayed characters.
After this command is executed, the cursor moves to the home position.

3.2. CAN (18 Hex): Clear Cursor Line
Clears the line containing the cursor.
  After this command is executed, the cursor moves to the left-end position on the cur-

rent line.

3.3. ESC @ (1B Hex + 40 Hex) : Initialize display

Resets the various display settings to their initial values.

The software settings are reset to their power-on values. The switches are not checked again except font selector switch #6. After initializing the display, the display screen will be cleared and the cursor moves to the home position.

3.4. ESC % n (1B Hex +25 Hex +n) : Select/cancel user defined character set n =0 or 1

Selects or cansels the user defined character set.

When n=1, the cursor defined character set is selected. When the cursor-defined character set is not defined using the ESC & command, the international character set is displayed.

When n=0, the user-defined character set is canceled. (The international character set is selected) In this case, this command has no effect on the user-defined characters that have already been defined using the ESC & command.

This command has no effect on the characters already displayed.

3.5. ESC & n p1, ... , p5 (1B Hex +26 Hex + n + p1, ..., p5) : define user-defined characters.

[Range]   20 Hex < n < 7E Hex
              0 < p1, ... , p5 < FF Hex

Define user-defined characters.

The user defined chracters can be downloaded by using this command. These font data are memorized in the RAM of the module.

Any 5 x 7 dots pattern consisting of data form p1 through p5 (4th - 8th byte) can be stored in the character code location specified by n (3-d byte).

Since the maximum number of user defined characters are 4 at once, trying to download more than 4 characters will delete the oldest one. If you download 4 new characters at once they will over-write the latest 4 characters.

Table 1 shows the relation between dot position and data formation. If a user wants to turn-on any dot, then he must transmit "H" level for corresponding bit. On the contrary, if a user wants to turn-off any dot, "L" level should be trasmitted.

Once the user-defined characters are defined, they remain effective until they are redefined; ESC @ is executed, or the power is turned off.

When only the user-defined characters are defined and the user-defined character set is not selected using the ESC % command, the user-defined characters are not displayed.

3.6. ESC ? n (1B Hex + 3F Hex + n): Cancel user-defined characters
[RANGE] 20 Hex < n < 7E Hex

Cancel User-defined characters.

This command cancels the patter defined for the character code specified by the 3-d byte (n). If the specified code is transmitted after the pattern is canceled by this command, the international character is displayed.
If the specified character code is not defined, this command is ignored.
This command has no effect on the characters already displayed.

3.7. ESC R n (1B Hex + 52 Hex + n) : Select an international character set.
[RANGE] 0 < n , 0A Hex (decimal)

When the power is turned on, the default value of n is 0 (set to USA)
Select an international character set n from Table 2.

3.8. ESC t n (1B Hex + 74 Hex + n): Select character code table
[RANGE] 0 < n < 1

Select a character code table.
When n = 0, the PC437 is selected. (Refer to Table 3.1)
When n = 1, the PC850 is selected. (Refer to Table 3.2)
This command has no effect on data displayed before this command is received.
This command has no effect on the selected international character set.
When the power is turned on, the value of "n" depends on the position of Switch # 6.
(When Switch is open, n = 0, and when switch is short: n = 1)

3.9. US MD1 (1F Hex + 01 Hex): Select overwrite mode

Selects overwrite mode as the screen display mode.
In overwriting mode, entering a character code moves to the left end of the lower line when the cursor is at the right end of the upper line, and to the left end of the upper line, when the cursor is at the right end of the lower line.
When the power is turned on, this mode is selected by default.

3.10. US MD2 (1F Hex + 02 Hex): Select vertical scroll mode

Selects vertical scroll mode as the screen display mode.
In vertical scroll mode, entering a character code moves the cursor to the left end of the lower line when the cursor is at the end of the right end of the upper line, scrolls the characters displayed on the lower line, and clears the lower line when the curdor is at the right end of the lower line.
At this moment the cursor is moved to the left end of the line.

3.11 US MD3 (1F Hex + 03 Hex): Select horizontal scroll mode.

Selects horizontal scroll mode, entering a character code scrolls all displayed characters one character to the left, then displays the new character at the right end (when the cursor is at the right end of either line).

3.12. US E n (1F Hex + 45 Hex + n) : Set display screen blink interval
[RANGE] 0 < n < FF Hex

Sets or cancels the blink interval of the display screen.
n specifies the blink interval. [(n x 13 msec) ON + (n x 13 msec) OFF] is repeated.

When n = 0, the display is kept on (cancel blinking).
When n = FF Hex (255 decimal), the display is turned off but the contents of the display are maintained.
When the power is turned on, n = 0 is selected by default.

3.13. US X n (1F Hex + 58 Hex + n) : Brightness adjustment
[RANGE] 1 < n < 4

Sets the brightness of the vacuum fluorescent character display tube.
n selects the percentage of brightness as follows:

n = 1, Brightness Level = 40 %
n = 2, Brightness Level = 60 %
n = 3, Brightness Level = 80 %
n = 4, Brightness Level = 100 %

When the power is turned ON, n = 4 is selected by default.

3.14. US # n m (1F Hex +23 Hex + n + m): Turn annunciator ON/OFF.
[RANGE]   n = 0 or 1
*   0 < m < 14 Hex (20 Decimal)*

Turns the annunciator at collumn *m* ON or OFF.
When *n* = 0, the annunciator at collumn m is turned OFF
When *n* = 1, the annunciator at collumn m is turned ON.
m - specifies the collumn number (the left-end collumn is collumn 1) where the annunciator to be turned On or OFF is located. However, when m equals 0, all annunciators are eighter OFF or ON, based on the corresponding value of n.

3.15. US @ (1F Hex +40 Hex): Execute Self-test

Execute a self test.
A series of self-tests is displayed. All set values except upper-defined character definitions are initialized.
After completion of self-tests, the screen is cleared and the display position is moved to the home position.

3.16. ESC H n (1B Hex + 48H + n) : Move cursor to specified position
[RANGE] 0< n < 27 Hex (39 Decimal)

Moves the cursor to the desired position.

	Left end	2-nd	3-d	Right end
Top	00	01	02	19
Bottom	20	21	22	39

	Left end	2-nd	3-d	Right end
Top	0H	01H	02H	13H
Bottom	14H	15H	16H	27H

3.17. ESC z (1B Hex + 7A Hex) : Resets all annunciators

3.18. US CR (1F Hex + 0D Hex) : Move the cursor to the right end position on the current line

Moves the cursor to right-end position of the current line.

3.19. US B (1F Hex + 42 Hex) : Move the cursor to the right-end position of the bottom line.

Moves the cursor to the right end position of the bottom line.

3.20. US $ n m (1F Hex + 24 Hex + n Hex + m Hex) : move the cursor to the n-th collumn of the m-th line

[RANGE] 1 < n < 14 Hex (20 Decimal)

1 < m < 2 Hex

This command allows user to move the cursor to the desired position on the display.

4. DEFALUTS (Initial States at Power-On)

The following Table 2.1. lists the default settings in effect at the time power is switched ON.

No	Items	Default Settings
1	Display mode	Overwrite Mode (US MD 1)
2	Cursor position	Home Position (Left-end of Upper row)
3	Display condition	Clear screen
4	Character code table	Depends on Switch # 6
5	International character set	USA
6	User defined characters	Undefined
7	Screen blinking	Turned OFF
8	Brightness	100%

5. OPERATING RECOMENDATIONS

5.1. Avoid applying excessive shock or vibration beyond the specification for the VFD module.

5.2 Since VFD are made of glass material, careful handling is required.

i.e. Direct impact with hard material to the glass surface may crack the glass.

5.3. When mounting the VFD module to your system, leave a slight gap between the VFD glass and your front panel. The module should be mounted without stress to avoid flexing of the PCB.

5.4. Avoid plugging or unplugging the interface connection with the power on, otherwise it may cause a severe damage to the input circuit.

5.5. Exceeding any of the maximum ratings may cause a permanent damage.
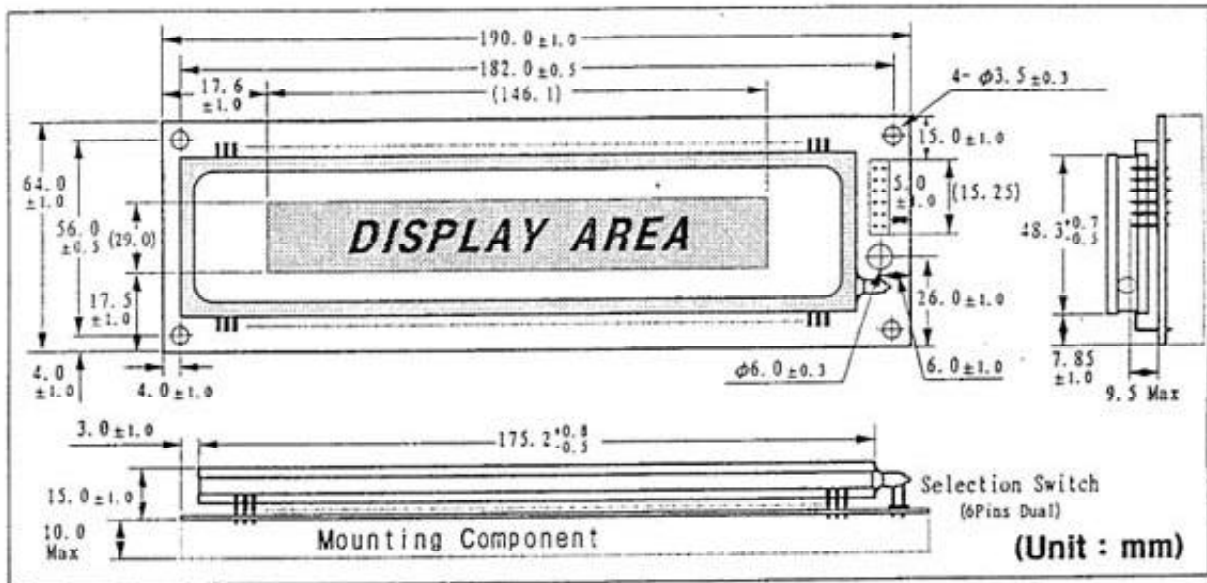
Fig-3. Outer Dimensions

4.12 Pattern Details

(Unit : mm)